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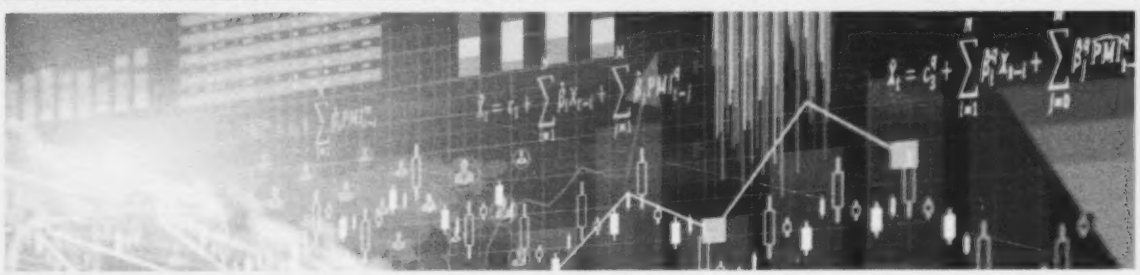
Capital Flows to Developing Countries: Is There an Allocation Puzzle?



by Josef Schroth

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Capital Flows to Developing Countries: Is There an Allocation Puzzle?

by

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Abstract

Foreign direct investment inflows are positively related to growth across developing countries—but so are savings in excess of investment. I develop an explanation for this well-established puzzle by focusing on the limited availability of consumer credit in developing countries together with general equilibrium effects. In my model, fast-growing developing countries increase their holdings of safe assets, which creates net capital outflows despite inflows of foreign direct investment. The world risk-free interest rate falls as a result, and slow-growing developing countries reduce their holdings of safe assets, which creates net capital inflows despite outflows of foreign direct investment.

Bank topics: Foreign reserves management; Interest rates; International financial markets
JEL codes: E13; E21; F43

Résumé

Les flux entrants d'investissements directs étrangers (IDE) présentent une relation positive avec la croissance dans l'ensemble des pays en développement – tout comme l'excédent de l'épargne sur les investissements. Pour expliquer cette énigme bien connue, je m'intéresse au rôle joué par l'accès limité au crédit à la consommation dans les pays en développement ainsi qu'aux effets d'équilibre général. Dans mon modèle, les pays en développement à forte croissance accumulent des actifs sûrs, ce qui crée des sorties nettes de capitaux, malgré les flux entrants d'IDE. Le taux d'intérêt sans risque mondial baisse en conséquence, et la détention d'actifs sûrs diminue dans les pays en développement à faible croissance, ce qui se traduit par des entrées nettes de capitaux, en dépit des flux sortants d'IDE.

Sujets : Gestion des réserves de change; Taux d'intérêt; Marchés financiers internationaux
Codes JEL : E13; E21; F43

Non-Technical Summary

Developing countries that grow faster tend to attract more foreign direct investment. However, they also tend to accumulate foreign reserves to an extent that turns them into net capital exporters. This observed negative relationship between net capital inflows and growth across developing countries is a puzzle. According to standard neoclassical growth theory, citizens of fast-growing developing countries are expected to save less than they invest in order to bring forward consumption in anticipation of higher future incomes.

I argue that advanced economies play a central role in explaining observed capital flow patterns across developing countries. The model in this paper takes into account that consumers in advanced economies have relatively better access to credit and that the growth of fast-growing developing countries affects world asset prices. In an equilibrium, citizens of developing countries hold buffer-stock savings in the form of safe assets that are claims on advanced-economy consumers. When some developing countries suddenly grow faster, they eventually accumulate even more safe assets. The world risk-free interest rate falls, as a result, and the remaining developing countries reduce their claims against advanced economies. Despite foreign direct investment flowing toward fast-growing developing countries, the fall in the world risk-free interest rate generates, on net, a negative relationship between growth and capital inflows across developing countries.

This paper abstracts from demographic changes and possible terms-of-trade manipulation by fast-growing developing countries. I focus on consumer borrowing limits that are tighter in developing countries than in advanced economies. For example, the reason capital has been flowing, on net, from China toward Africa might, paradoxically yet simply, be the fact that China has been growing faster.

1 Introduction

It is a well-documented fact that capital inflows and growth tend to be negatively related across developing countries (Prasad et al., 2007; Gourinchas and Jeanne, 2013). This fact, or puzzle, contradicts standard neoclassical growth theory, which predicts a strong positive relation stemming from consumption-smoothing motives and ample investment opportunities in fast-growing developing countries. So far, the literature has focused on explanations for the puzzle that center around frictions hampering physical capital investment in developing countries (Song et al., 2011; Sandri, 2014; Buera and Shin, 2016). This paper, in contrast, focuses on the role of financial frictions constraining consumption smoothing in those countries.[1]

My paper builds on the literature that explains capital flows between developing and developed countries with a relative scarcity of safe assets in developing countries. This literature emphasizes either lower collateral value of physical capital (Caballero et al., 2008) or higher individual income risk (Mendoza et al., 2009; Angeletos and Panousi, 2011) in developing relative to developed countries. In my model economy, I generate high net demand for safe assets in developing countries with consumer borrowing limits that are tighter than those in developed countries and study capital flows across developing countries that grow at different speeds. Specifically, when some developing countries suddenly grow faster, they eventually accumulate more claims against developed countries. The world risk-free interest rate falls, as a result, and the remaining developing countries reduce their claims against developed coun-

[1] In the case of China, a large fast-growing developing country, there are only limited loans to nonstate enterprises and households (Yang, 2012). Chinese households actually increased their average savings rate during the period 1995–2005 (Chamon and Prasad, 2010), possibly due to life-cycle concerns in the presence of household credit constraints (Song and Yang, 2010; Curtis et al., 2015; Coeurdacier et al., 2015). I focus on how household credit constraints affect capital flows between developing countries that grow at different speeds and abstract from how they might affect savings rates in certain fast-growing developing countries.

tries. Despite foreign direct investment (FDI) flowing towards fast-growing developing countries, the fall in the world risk-free interest rate generates, on net, a negative relationship between growth and capital inflows across developing countries.

The economic rise of China has significantly affected global capital flows. Specific circumstances such as life-cycle changes and policies designed to promote exports contributed to the buildup of large foreign reserves during the time of high growth in China (Yang, 2012).[2] Similarly, higher Chinese household savings stemming from higher incomes largely also ended up invested in low-yielding foreign-issued safe assets as a result of an underdeveloped financial system that limits the flow of savings to domestic entrepreneurs and consumers. In this paper, I abstract from life-cycle effects and possible terms-of-trade manipulation by fast-growing developing countries. Instead, I focus on the effect of tighter consumer borrowing limits in developing countries relative to developed countries. The contribution of this paper is to show that capital is flowing, on net, from fast-growing to slow-growing developing regions—despite net FDI flows in the opposite direction—even if total factor productivity (TFP) advancements are the only difference between those regions. For instance, the reason capital has been flowing, on net, from China toward Africa might, paradoxically yet simply, be the fact that China has been growing faster.

A number of papers explain a negative relationship between capital inflows and growth across developing countries by emphasizing financial frictions faced by entrepreneurs. In Song et al. (2011) and Buera and Shin (2016) a growth-enhancing sectoral reallocation of physical capital is triggered by economic reforms that make nonstate entrepreneurs relatively more productive compared with state-owned enterprises. Since entrepreneurs face relatively tighter financing constraints, they choose

[2]In addition, Costinot et al. (2014) argue that fast-growing countries may be able to improve their inter-temporal terms of trade by restricting borrowing from abroad or, equivalently, by increasing savings in foreign assets.

to increase their savings. Workers do not hold precautionary savings in Buera and Shin (2016), which implies that any (feasible) decrease in worker savings due to life-cycle reasons is small and more than offset by the increase in savings by current and would-be entrepreneurs. In Song et al. (2011) workers have a strong motive to save due to life-cycle reasons and thus accumulate foreign assets due to decreasing funding demand by state enterprises. The physical capital re-allocation channels in those two papers are very potent—as long as entry of foreign entrepreneurs and enterprises is restricted—since they drastically reduce the ability of savers to satisfy funding demand of domestic producers in equilibrium (as production shifts from public enterprises to private entrepreneurs). Endogenously, therefore, economic development improves while financial development deteriorates. In Sandri (2014) entrepreneurs choose to increase investment in physical capital when its productivity increases exogenously and also increase their savings to self-insure against idiosyncratic investment risk. Since workers are assumed to consume their wage in every period, the net effect is an increase in aggregate savings for developing countries that experience growth.[3]

In contrast to these papers, I focus on household savings and do not require the capital account to be closed for physical capital, i.e., for FDI.[4] Gourinchas and Jeanne (2013) find that the "allocation puzzle"—the fact that capital inflows tend to be negatively related to growth—is actually more pronounced for developing countries with relatively more open capital accounts. I focus on long-run growth dynamics due to exogenous productivity catch-up, as in Gourinchas and Jeanne (2013), and assume the capital account is completely open in the long run. The analysis in this paper shows that financial frictions related to consumption, rather than investment, can potentially

[3]Bacchetta and Benhima (2015) also focus on the case where producers in developing countries increase their demand for safe assets whenever they invest more.

[4]FDI flows are economically significant relative to net exports in China (Zhang and Song, 2002; Dollar and Kraay, 2006). Indeed, developing Asia and in particular China receive a large share of the world's FDI (Zhang, 2005; UNCTAD, 2015).

contribute to explaining the allocation puzzle over the long run.

Mendoza et al. (2009) and Carroll and Jeanne (2015) show that a negative relationship between capital inflows and permanent increases in the growth rate can be obtained in models with precautionary savings when higher growth also implies increased idiosyncratic risk in relative terms. Note that their theories go beyond the observed stylized facts that focus on temporarily higher growth rates and capital inflows in developing countries (Gourinchas and Jeanne, 2013; Sandri, 2014; Buera and Shin, 2016). In my model, a temporarily elevated growth rate leads to higher idiosyncratic risk in absolute terms simply by increasing incomes.

Gourinchas and Jeanne (2013) and Alfaro et al. (2014) show that foreign reserve accumulation by government agencies, such as central banks, in fast-growing developing countries is a major driving force behind the allocation puzzle. Foreign reserves are often held in the form of foreign government debt and sterilized with domestic bank reserves. A potential explanation for government-to-government, rather than citizen-to-citizen, international capital flows could be that governments are more likely than individual citizens to repay foreign creditors (Jeske, 2006), together with a preference of domestic savers to hold domestic bank deposits rather than higher-yielding foreign assets (French and Poterba, 1991). Thomas and Worral (1994) and Aguiar and Amador (2011) suggest that foreign reserves could be a means of alleviating fear of expropriation by owners of FDI in developing countries. However, reserves would have to increase more than one-for-one with FDI to explain the allocation puzzle (which is also not the objective of these papers). A similarity between their models and mine is that my model generates FDI inflows that are positively related to growth, as in the data (Alfaro et al., 2014), while much of the remaining literature abstracts from FDI (e.g., Buera and Shin, 2016).

2 Model

Agents, preferences and uncertainty

The economy consists of three regions, denoted by D (developing region), E (fast-growing developing region) and U (developed region). There are two goods, labor and consumption. In region i there is a measure $\mu^i > 0$ of consumers with identical preferences that rank consumption sequences $\{c_t\}_{t=0,1,2,...}$ according to

$$\mathrm{E}_0 \sum_{t=0} \beta^t u(c_t), \tag{1}$$

where $u(c) = \frac{c^{1-\sigma}-1}{1-\sigma}$ with $\sigma > 0$, $\beta \in (0,1)$ is a subjective discount factor, and E_0 denotes date zero expectations. While there is no aggregate uncertainty, the random variables $\xi \in \{\xi_L, \xi_H\}$ and $z \in \{0, z_H\}$ denote idiosyncratic labor productivity and investment productivity respectively.

Markets and income from labor and capital

Consumers each supply one unit of labor inelastically in their region of residence (labor is not mobile across regions). In each region there is a competitive spot market for (domestically supplied) labor. Consumers also have access to an economy-wide market for a non-contingent one-period bond. As there is no aggregate uncertainty, the paths for wages and bond prices are deterministic; denote them $\{w_t^i\}_{t=1,2,...}$ (for $i = D, E, U$) and $\{q_t\}_{t=1,2,...}$ respectively. For instance, a consumer in region i with idiosyncratic labor productivity shock ξ receives labor income of $w_t^i \xi$ in period t. Call consumers with current high investment productivity $z > 0$ "entrepreneurs" and consumers with zero investment productivity "workers." Entrepreneurs can invest capital in any region to produce the consumption good.[5] Capital can be costlessly and instantaneously trans-

[5]Entrepreneurs also earn labor income independently from their investment decision, so there is no occupational choice problem for consumers.

formed into the consumption good and vice versa. In particular, an entrepreneur in any region who invests k_{t+1} units of capital in period t in region $j \in \{D, E, U\}$, experiences investment productivity shock $z_{t+1} > 0$ and hires labor l_{t+1} in region j receives

$$A^j z_{t+1} \left(k_{t+1}^{\alpha} l_{t+1}^{1-\alpha}\right)^{\gamma} + (1-\delta)k_{t+1} \tag{2}$$

units of the consumption good in period $t+1$, where $\alpha \in (0,1)$, $\gamma \in (0,1)$ introduces decreasing returns to scale, $\delta \in (0,1)$ is the capital depreciation rate, and A^j denotes aggregate region-specific investment productivity. Entrepreneurs are free to invest in any region, and their idiosyncratic productivity is perfectly correlated across possible production sites, but I assume that they can invest in only one region at a time.

Consumer problem

A consumer in region i chooses sequences for consumption, risk-free bonds, capital, labor and production sites, $\{c_t, b_{t+1}, k_{t+1}, l_t, (\chi_t^{ij})_{j=D,E,U}\}_{t=0,1,2,...}$, in order to maximize lifetime utility given by (1), subject to a sequence of budget and borrowing constraints given by

$$c_t + q_{t+1}b_{t+1} + k_{t+1} = \sum_{j=D,E,U} \chi_t^{ij} \left[A^j z_t \left(k_t^{\alpha} l_t^{1-\alpha}\right)^{\gamma} - w_t^j l_t\right] + (1-\delta)k_t + b_t + w_t^i \xi_t, \tag{3}$$

and

$$b_{t+1} + \theta_1^i w_{t+1}^i + \theta_2^i k_{t+1} \geq 0, \tag{4}$$

respectively, as well as non-negativity of consumption, capital and labor choices. Production site choices are constrained to be such that $\chi_t^{ij} = 1$ if the consumer chooses to invest in region j and zero else, with $\sum_j \chi_t^{ij} \leq 1$. Consumers with zero investment productivity, i.e., workers, are assumed to set $k_{t+1} = 0$ and choose $l_t = 0$. (This assumption is not necessary if $\gamma = 1$.) The parameters $\{\theta_1^i\}_{i=D,E,U}$ are related to the pledgeability

of labor income, while the parameters $\{\theta_2^i\}_{i=D,E,U}$ are related to the pledgeability of capital. I follow Caballero et al. (2008) and Mendoza et al. (2009) in assuming that the developed region U has more sophisticated financial markets. Specifically, I assume $\theta_j^U \geq \theta_j^D = \theta_j^E$ for $j = 1, 2$ such that citizens of U have better access to debt financing.

Aggregation and equilibrium

Let ν_t^i denote the cross-sectional distribution of consumers in region $i = D, E, U$ in period t. Define the aggregate quantities "labor demand" and "bond demand" in region i as

$$L_t^i = \sum_{j=D,E,U} \int \chi_t^{ji} l_t^j d\nu_t^j, \quad B_t^i = \int b_t^i d\nu_t^i.$$

Definition 1 (Market clearing). *We say that prices $\{(w_t^i)_{i=D,E,U}, q_{t+1}\}_{t=0,1,2,\ldots}$ clear markets for labor and bonds if*

$$L_t^i = \mu^i \text{ for } i = D, E, U, \text{ and}$$
$$\sum_i \mu^i B_{t+1}^i = 0,$$

for all $t = 0, 1, 2, \ldots$.

Definition 2 (Competitive equilibrium). *Sequences of consumer choices together with prices that clear markets constitute a competitive equilibrium.*

An entrepreneur who invests k_{t+1} in period t must be indifferent between production sites in a competitive equilibrium. As a result, wages in developing regions can be expressed in terms of the wage in the developed region as follows:

$$w_t^i = \left(\frac{A^i}{A^U}\right)^{\frac{1}{(1-\alpha)\gamma}} w_t^U, \quad i = D, E. \tag{5}$$

Note that, since entrepreneurs are indifferent between production sites, the labor mar-

ket clearing condition in Definition 1 can be replaced by the weaker but still sufficient condition $\sum L_t^i = \sum \mu^i$.

3 Capital Flows Across Developing Countries

This section addresses the question of which net capital flows across developing regions D and E arise if developing region E experiences an increase in its TFP. The first step is to calibrate the model, and the second step is to compare an initial steady state with the steady state that arises after the productivity increase in country E. Note that I focus on this latter "new steady state" when calibrating the model. I then compare the changes in net foreign asset positions and TFP between the initial steady state and the new steady state to the results in Gourinchas and Jeanne (2013), who compare cumulative capital flows and cumulative productivity growth.

3.1 Calibration

Let D refer to Latin America, the Middle East and Central Europe, E to developing Asia and U to advanced economies in the rest of the world. Table 1 summarizes current shares of world population and world output for each region. The data source is the World Bank, the date is 2012, and output is gross domestic product measured in 2012 US dollars. Let Y^i denote current output for $i = D, E, U$. We immediately obtain $\mu^D = \mu^E = 0.425$ and $\mu^U = 0.15$. Normalizing $A^D = 1$ and using Lemma 1, we further obtain $A^E = 1.28$ and $A^U = 4.92$ as the levels of TFP consistent with current output and population shares.

	Population share	Output share
D	0.425	0.1528
E	0.425	0.2222
U	0.150	0.6250

Table 1. Shares in world population and world output.

Lemma 1. *Current population and output shares are related to current total factor productivity as follows:*

$$\frac{Y^i}{\sum_j Y^j} = \frac{A^{i\frac{1}{(1-\alpha)\gamma}}\mu^i}{\sum_j A^{j\frac{1}{(1-\alpha)\gamma}}\mu^j}, \quad i = D, E, U.$$

Proof. Entrepreneurs' conditions for optimal labor demand can be used to obtain

$$\frac{Y^i}{\sum_j Y^j} = \frac{w^i\mu^i}{\sum_j w^j\mu^j}, \quad i = D, E, U.$$

The result then follows by substituting in the no-arbitrage condition (5). □

For the coefficient of relative risk aversion, σ, I choose 2, which is within the range of values used in the literature. The capital share α is set to 0.35, and the depreciation rate is set to $\delta = 0.067$. I set $\gamma = 1$ to rule out decreasing returns to scale in capital—for a given wage—as a driving force behind strong capital flows toward the developed region via FDI. The transition matrix for labor productivity is symmetric, where productivity levels and the probability of remaining in the same state are chosen such that the natural logarithms of productivity levels have an autocorrelation of 0.90 and a standard deviation of 0.30, which is close to estimates in Storesletten et al. (2004). Normalizing the unconditional mean of idiosyncratic labor productivity to 1 yields $\xi_L = 0.71$ and $\xi_H = 1.29$, as well as a probability of remaining in the same state of 0.95. The transition matrix for investment productivity P_z is chosen such that the fraction of entrepreneurs is 12.5 percent and the fraction of entrepreneurs ceasing to be productive each period is 23 percent. The value for high investment productivity is set

to 1. I set $\theta_1^D = 0$ to reflect lower financial development in developing regions D and E.

Choosing the remaining four model parameters requires solving for the steady state of the economy. The subjective discount factor β is chosen to generate a capital-to-output ratio of 3.1 in region U. The parameters θ_1^U and θ_2^D are chosen to achieve aggregate bond holdings equal to negative 10 percent of GDP and a 2.5 percent net position with respect to physical capital investment in region U. Note that $\theta_1^U - \theta_1^D > 0$ implies that financial intermediation in region U is relatively more productive, compared with regions D and E, in the sense of allocating more (unsecured) credit to consumers. Consumers with low net worth in region U will thus borrow from consumers with high net worth in regions D and E (see for example Bernanke, 2005). Also note that $\theta_2^U - \theta_2^D > 0$ is small in the calibration of the model in this paper, generating a positive net position in FDI in region U that is in absolute terms small compared with its negative net position in risk-free debt (see for example Lane and Milesi-Ferretti, 2007b).

I choose targets for net portfolio debt and FDI that are between zero and the value for the respective average position in the United States (see Figure 2.8 in Lane and Milesi-Ferretti, 2007b). Specifically, I choose positions that are less pronounced than the ones reported for the United States to account for the fact that externally held wealth by citizens in developed countries, such as the United States, may be underreported.[6] Finally, I choose the collateral parameter θ_2^U such that the annual risk-free interest rate is 2 percent.

[6]Lane and Milesi-Ferretti (2007a) show that wealthy countries often report liabilities that exceed corresponding claims reported by other countries. Zucman (2013) argues that some of these other countries assist residents of wealthy countries to conceal holdings of wealthy-country assets. This suggests that the external wealth of wealthy countries is underestimated in the official data.

Parameter	Explanation	Value	Target
σ	CRRA coefficient	2	within range of literature
δ	depreciation rate	0.067	replacement investment
α	capital share	0.35	average capital income share
P_ζ	labor productivity process	$\left(\begin{smallmatrix} 0.95 & 0.05 \\ 0.05 & 0.95 \end{smallmatrix}\right)$	autocorrelation log earnings
ζ	values labor shock	$(0.71 \; 1.29)$	Std deviation log earnings
P_z	investment productivity process	$\left(\begin{smallmatrix} 0.97 & 0.23 \\ 0.03 & 0.77 \end{smallmatrix}\right)$	overall fraction and exit rate of entrepreneurs
z	values investment shock	$(0 \; 1)$	normalization
β	discount factor	0.95	capital-output ratio of 3.1
θ_1^D	borrowing limit	0	lower financial development in D, E
θ_2^D	collateral parameter	0.79	net external physical capital U
θ_1^U	borrowing limit	0.44	net external debt U
θ_2^U	collateral parameter	0.80	risk-free rate of 2 percent

Table 2. Calibration of model parameters.

3.2 Is there an allocation puzzle?

In this section I use the model to study capital flows that arise due to growth differentials across developing countries. Specifically, I compare the steady state used to calibrate the model with an initial steady state in which I set TFP of region E, A^E, to 1. All other model parameters are unchanged in the initial steady state. In particular, developing countries in region E catch up in terms of production technology but not in terms of financial development. By comparing changes in foreign asset positions between these two steady states, I can relate cumulative capital flows to cumulative productivity gains across developing countries.

Table 3 compares the initial steady state, or "old steady state," with the steady state used to calibrate the model (the new steady state). Since developing regions D and E account for a higher share of world output in the new steady state, due to higher TFP in region E compared with the old steady state, the demand for risk-free assets increases. As a result, both the return on risk-free assets and the return on productive capital decrease, by 3.5 and 14 basis points, respectively.

Region E increases its lending to region U, which causes region U's net position in risk-free assets to deteriorate further. The increase in productive capital that region U entrepreneurs invest in region E is small by comparison such that the net effect on the foreign asset position of region U is negative. On the other hand, the fast-growing developing region E experiences an increase in its net foreign asset position—i.e., an increase in holdings of foreign debt that more than offsets the inflow of FDI. Capital, on net, flows out of the fast-growing developing region E.

The increased lending of region E to region U decreases the risk-free interest rate such that region D reduces its holdings of risk-free assets. The slow-growing developing region D also increases its investment of productive capital in the fast-growing developing region E. However, this FDI outflow is more than offset by the reduction in risk-free asset holdings. Capital, on net, flows into the slow-growing developing region.

When region E enjoys sudden TFP growth, then it experiences a capital outflow into region D—which did not enjoy any improvements in TFP—such that growth and capital inflows are negatively related across developing regions. The allocation puzzle established in Gourinchas and Jeanne (2013) thus appears less puzzling when taking into account the fact that consumers in developing countries face greater difficulties in obtaining credit for the purpose of consumption compared with consumers in developed countries. In particular, the puzzle need not imply institutional differences, other than those directly affecting the profitability of capital investment, between fast- and slow-growing developing countries.

Yang (2012) argues that the financial system in China has only a limited ability to pass private savings on to borrowers in the form of consumer credit. The changes in net foreign asset positions of region E indicated in Table 3 are small compared with capital flows experienced by China. The reason is that China is only one of the countries in

developing Asia (region E); for example, China's TFP arguably increased by more than 28 percent during recent decades. Quantitatively larger capital flows for a given region can therefore be obtained by choosing the three regions in the model accordingly.

Fast-growing developing countries may face challenging life-cycle changes (Song and Yang, 2010), higher uninsurable individual risk (Mendoza et al., 2009; Carroll and Jeanne, 2015), or capital controls with respect to FDI (Sandri, 2014). These factors play an important role in shaping international capital flows. However, the model shows that the simple fact that consumer credit is relatively harder to come by in developing—compared with developed—countries by itself already causes capital to flow out of fast-growing and into slow-growing developing countries.

Autarky in initial steady state

Suppose regions cannot trade safe assets among each other and, in addition, cannot invest productive capital in another region in the initial steady state. Then the risk-free rate and the return on physical capital investment are different in developing and developed regions in the initial steady state. Suppose further that capital flows across regions become feasible when region E experiences its increase in TFP. Table 4 shows capital flows that arise by comparing the initial steady state to the new steady state. On the one hand, capital flows from developing regions toward the developed region (see also Mendoza et al., 2009). On the other hand, more capital flows out of the fast-growing developing region E than out of the slow-growing developing region D. Capital inflows are again negatively related to growth across developing regions.

3.2.1 Policy implications for slow-growing developing countries

There has been much discussion about potential reasons behind international capital flows. In particular, many factors are thought to contribute to foreign asset positions

	Old steady state			New steady state		
	D	*E*	*U*	*D*	*E*	*U*
Return on risk-free asset		2.091			2.056	
Return on productive capital		4.624			4.610	
Net foreign asset positions	14.59	14.59	-7.13	13.55	13.55	-8.13
risk-free assets	18.81	18.81	-9.20	17.53	17.53	-10.52
productive capital	-4.22	-4.22	2.07	-3.98	-3.98	2.39
Change in net foreign asset positions				-1.03	5.13	-1.00
risk-free assets				-1.27	6.70	-1.33
productive capital				0.24	-1.57	0.33

Table 3. Capital flows across developing regions.

Net foreign asset positions are in percent of gross domestic product for each steady state. Changes in net foreign asset positions are in percent of initial steady state gross domestic product.

of fast-growing developing countries such as China (e.g., Yang, 2012). The analysis in this paper suggests that slow-growing developing countries are affected by a "savings glut" (Bernanke, 2005) caused by fast-growing developing countries in a manner similar to developed countries.[7] The driving force behind capital flows from fast-growing to slow-growing developing countries may thus not be government intent but an inability to convert higher incomes in fast-growing developing countries, via financial intermediation, into higher domestic consumption. Also note that the presence of the developed region *U* is crucial—without it there would be no general equilibrium effects due to the TFP increase in *E* and no capital flows across developing countries.

4 Conclusion

The empirical literature does not find much support for capital flowing towards fast-growing developing countries (Prasad et al., 2007). In fact, the data even suggest a negative relation between capital inflows and growth across developing countries (Gourin-

[7]For instance, Chinese capital flows into a slow-growing developing region such as Africa tend to take the form of loans at market rates rather than FDI or official development aid (see Wharton, 2016; Chen et al., 2016, as well as data from the China Africa Research Initiative at John Hopkins University).

	Old steady state			New steady state		
	D	*E*	*U*	*D*	*E*	*U*
Return on risk-free asset	1.564	1.564	2.307		2.056	
Return on productive capital	4.384	4.384	4.726		4.610	
Net foreign asset positions	0	0	0	13.55	13.55	-8.13
risk-free assets	0	0	0	17.53	17.53	-10.52
productive capital	0	0	0	-3.98	-3.98	2.39
Change in net foreign asset positions				13.40	19.49	-8.17
risk-free assets				17.34	25.22	-10.58
productive capital				-3.94	-5.73	2.40

Table 4. Capital flows across developing regions with autarky in old steady state.

Net foreign asset positions are in percent of gross domestic product for each steady state. Changes in net foreign asset positions are in percent of initial steady state gross domestic product.

chas and Jeanne, 2013). While FDI seems to flow in the "right" direction—i.e., towards fast-growing developing countries—the latter, and especially China, accumulate substantial savings in the form of developed country sovereign debt (Yang, 2012). These large external savings offset flows of FDI and present a puzzle to researchers as well as policy-makers.

This paper makes two straightforward observations. First, consumers in developing countries tend to have worse access to credit compared with consumers in developed countries, and this gap in financial development persists even after improvements in economic development in a developing country have taken place. Second, the emergence of some developing countries as fast-growing developing countries significantly changes their contribution to world output and creates general equilibrium effects via a global savings glut.

I build a model where relatively tighter borrowing constraints in developing countries imply that part of the income generated by an improvement in TFP finances foreign rather than domestic consumption. In addition, the resulting lower world risk-free interest rate induces consumers in slow-growing developing countries to borrow more. Savings flows from fast-growing to slow-growing developing countries more than off-

set investment flows in the opposite direction. Growth and capital inflows are, as a result, negatively related across developing countries.

The Chinese economy is an important driving force behind global capital flows across developing countries. It is also uniquely characterized by a combination of demographic challenges and economic policies. This paper shows that observed capital flow patterns need not be due to unique circumstances or special policies. Instead, observed patterns can arise when a developing region, such as China, that is growing fast is not able to convert higher incomes into higher aggregate consumption due to an under-developed financial intermediation sector.

References

Aguiar, M. and M. Amador (2011). Growth in the shadow of expropriation. *The Quarterly Journal of Economics 126*, 651–697.

Alfaro, L., S. Kalemli-Ozcan, and V. Volosovych (2014). Sovereigns, upstream capital flows, and global imbalances. *Journal of the European Economic Association 12*(5), 1240–1284.

Angeletos, G.-M. and V. Panousi (2011). Financial integration, entrepreneurial risk and global dynamics. *Journal of Economic Theory 146*(3), 863–896.

Bacchetta, P. and K. Benhima (2015). The demand for liquid assets, corporate saving, and international capital flows. *Journal of the European Economic Association 13*(6), 1101–1135.

Bernanke, B. (2005). The global saving glut and the US current account deficit. Speech, Board of Governors of the Federal Reserve System (US).

Buera, F. and Y. Shin (2016). Productivity growth and capital flows: The dynamics of reforms. *American Economic Review* (forthcoming).

Caballero, R., E. Farhi, and P.-O. Gourinchas (2008). An equilibrium model of "global imbalances" and low interest rates. *American Economic Review* (1), 358–393.

Carroll, C. D. and O. Jeanne (2015). A tractable model of precautionary reserves, net foreign assets, or sovereign wealth funds. Technical report.

Chamon, M. D. and E. S. Prasad (2010). Why are saving rates of urban households in China rising? *American Economic Journal: Macroeconomics 2*(1), 93–130.

Chen, W., D. Dollar, and H. Tang (2016). Why is China investing in Africa? Evidence from the firm level. *The World Bank Economic Review*.

Coeurdacier, N., S. Guibaud, and K. Jin (2015). Credit constraints and growth in a global economy. *The American Economic Review 105*(9), 2838–2881.

Costinot, A., G. Lorenzoni, and I. Werning (2014). A theory of capital controls as dynamic terms-of-trade manipulation. *Journal of Political Economy 122*(1), 77–128.

Curtis, C. C., S. Lugauer, and N. C. Mark (2015). Demographic patterns and household saving in China. *American Economic Journal: Macroeconomics 7*(2), 58–94.

Dollar, D. and A. Kraay (2006). Neither a borrower nor a lender: does China's zero net foreign asset position make economic sense? *Journal of Monetary Economics 53*(5), 943–971.

French, K. R. and J. M. Poterba (1991). Investor diversification and international equity markets. *The American Economic Review 81*(2), 222–226.

Gourinchas, P.-O. and O. Jeanne (2013). Capital flows to developing countries: The allocation puzzle. *The Review of Economic Studies*, rdt004.

Jeske, K. (2006). Private international debt with risk of repudiation. *Journal of Political Economy 114*(3), 576–593.

Lane, P. R. and G. M. Milesi-Ferretti (2007a). The external wealth of nations mark II: Revised and extended estimates of foreign assets and liabilities, 1970–2004. *Journal of International Economics 73*(2), 223–250.

Lane, P. R. and G. M. Milesi-Ferretti (2007b). A global perspective on external positions. In *G7 current account imbalances: sustainability and adjustment*, pp. 67–102. University of Chicago Press.

Mendoza, E., V. Quadrini, and J. Ríos-Rull (2009). Financial integration, financial development, and global imbalances. *Journal of Political Economy 117*(3), 371–416.

Prasad, E., R. Rajan, and A. Subramanian (2007). Foreign capital and economic growth. *Brooking Papers on Economic Activity* (Spring), 153–230.

Sandri, D. (2014). Growth and capital flows with risky entrepreneurship. *American Economic Journal: Macroeconomics 6*(3), 102–123.

Song, M. and D. T. Yang (2010). Life cycle earnings and the household saving puzzle in a fast-growing economy. *Manuscript, Chinese University of Hong Kong*.

Song, Z., K. Storesletten, and F. Zilibotti (2011). Growing like China. *The American Economic Review 101*(1), 196–233.

Storesletten, K., C. Telmer, and A. Yaron (2004). Cyclical dynamics in idiosyncratic labor market risk. *Journal of Political Economy 112*(3).

Thomas, J. and T. Worral (1994). Foreign direct investment and the risk of expropriation. *Review of Economic Studies* (61), 81–108.

UNCTAD (2015). World investment report 2015. *United Nations Conference on Trade and Development*.

Wharton (2016). China's investments in Africa: What's the real story? http://knowledge.wharton.upenn.edu/article/chinas-investments-in-africa-whats-the-real-story/.

Yang, D. T. (2012). Aggregate savings and external imbalances in China. *The Journal of Economic Perspectives 26*(4), 125–146.

Zhang, K. H. (2005). Why does so much FDI from Hong Kong and Taiwan go to mainland China? *China Economic Review 16*(3), 293–307.

Zhang, K. H. and S. Song (2002). Promoting exports: the role of inward FDI in China. *China Economic Review 11*(4), 385–396.

Zucman, G. (2013). The missing wealth of nations: Are Europe and the US net debtors or net creditors? *The Quarterly Journal of Economics 128*(3), 1321–1364.